

A Novel Smart Pan/Tilt/Zoom Visible/Infrared Sensor for UAV On-Board Video Surveillance of Launch Range, Phase I

Completed Technology Project (2009 - 2009)



Project Introduction

NASA has a pressing need for increasing the efficiency of launch range surveillance during mission launch operations. Difficulty in verifying a cleared range causes significant launch delay that may significantly affect the operation safety, cost and schedule. We propose this SBIR to develop a novel "Smart Pan/Tilt/Zoom Visible/IR Sensor" platform, especially suited for detection, tracking, recognition, and identification of persons and objects that have intruded areas of the range that must be cleared in order to conduct safe launch operations. Conventional optical sensors have limited field of views (FOV). They observe objects through a small solid angle subtended in front of the sensor. Although the high optical amplification may provide high resolution image of a target, detecting and tracking potential target within a large area is difficult, resulting in lengthy search time, costly UAV maneuvers, low efficiency of verifying range clearance, even missing intruded target due to limited FOV. Increasing FOV, however, is a double-edged sword that, for any given sensor, leads to a decreased spatial resolution, causing difficulties in target recognition and classification. To address these contradicting requirements on FOV and resolution for range surveillance applications, we propose a novel Smart PTZ sensor concept with the following unique advantages: (1)Novel optical design of wide FOV optics, no blind spot, no image distortion; (2)Simultaneous wide FOV and zoomed high resolution images; (3)Smart PTZ target tracking; (4)Intelligent video analysis algorithms for automatic target detection and tracking; (5)Embedded on-board DSP processing module; (6)Novel optical design applies to both visible and infrared sensors; (7)Flexible mounting options: on-board UAV, land vehicle mounted, and fixed camera.

Anticipated Benefits

Beyond NASA uses, the proposed Smart PTZ sensor has immediate commercial applications to various applications in homeland security, video monitoring, and IP based remote video surveillance. According to Frost & Sullivan, the global video surveillance industry is about \$7 billion, which is expected to grow to \$13 billion within five years, with 44% growth market on the verge of technological breakthrough. The video surveillance market is considered as a limitless growth market. "Cameras Everywhere" continues to be the best description of the trend in the Video Surveillance market. The new advanced 360° imaging and Smart PTZ technology will lead to a number of innovative products and vast applications to various video surveillance fields, with unprecedented performance, resolution, image quality, cost efficiency, and ease of use. The proposed Smart PTZ technology solves the critical problem of conventional optical sensors that are not able to satisfy the contradicting requirements of achieving both wide FOV and high resolution target imaging capabilities. By integrating both wide FOV sensor and agile PTZ sensor within a compact package, together with a set of intelligent video analysis algorithms running on an embedded DSP platform, the proposed Smart PTZ sensor system is able to achieve unprecedented performance in



A Novel Smart Pan/Tilt/Zoom Visible/Infrared Sensor for UAV On-Board Video Surveillance of Launch Range, Phase I

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3

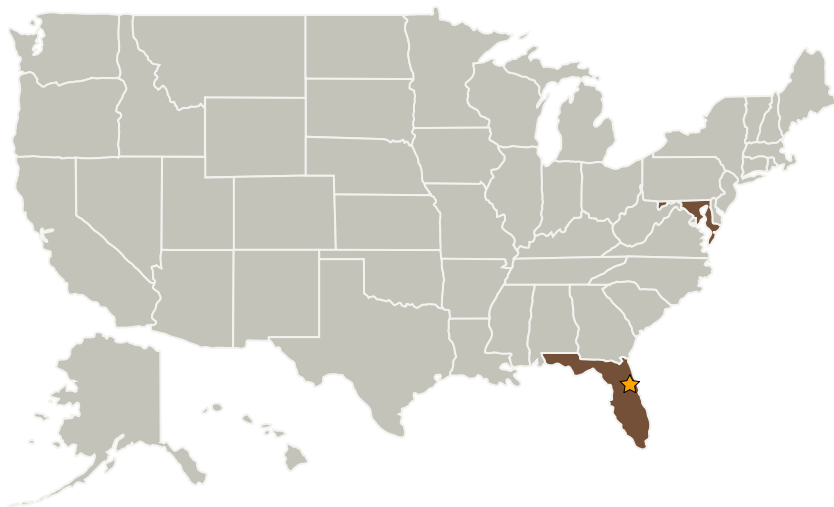
A Novel Smart Pan/Tilt/Zoom Visible/Infrared Sensor for UAV On-Board Video Surveillance of Launch Range, Phase I

Completed Technology Project (2009 - 2009)



target detection, tracking, recognition and classification, within a very large FOV (up to entire 360-degree FOV). The compact light weight and low-power visible/infrared sensor package is ideally suited for mounting on UAVs and land vehicles for launch range surveillance. The system can also be installed in fixed locations with critical importance for constant 7/24 real-time video surveillance with intelligent target detection capabilities. The proposed Smart PTZ visible/Infrared sensor technology offers an efficient, low-cost, and high performance solution to NASA launch range surveillance applications.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Xigen, LLC	Supporting Organization	Industry	Rockville, Maryland

Primary U.S. Work Locations

Florida	Maryland
---------	----------

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Jennifer Murray

Principal Investigator:

Jason Geng

A Novel Smart Pan/Tilt/Zoom Visible/Infrared Sensor for UAV On-Board Video Surveillance of Launch Range, Phase I

Completed Technology Project (2009 - 2009)



Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX16 Air Traffic Management and Range Tracking Systems
 - └ TX16.5 Range Tracking, Surveillance, and Flight Safety Technologies